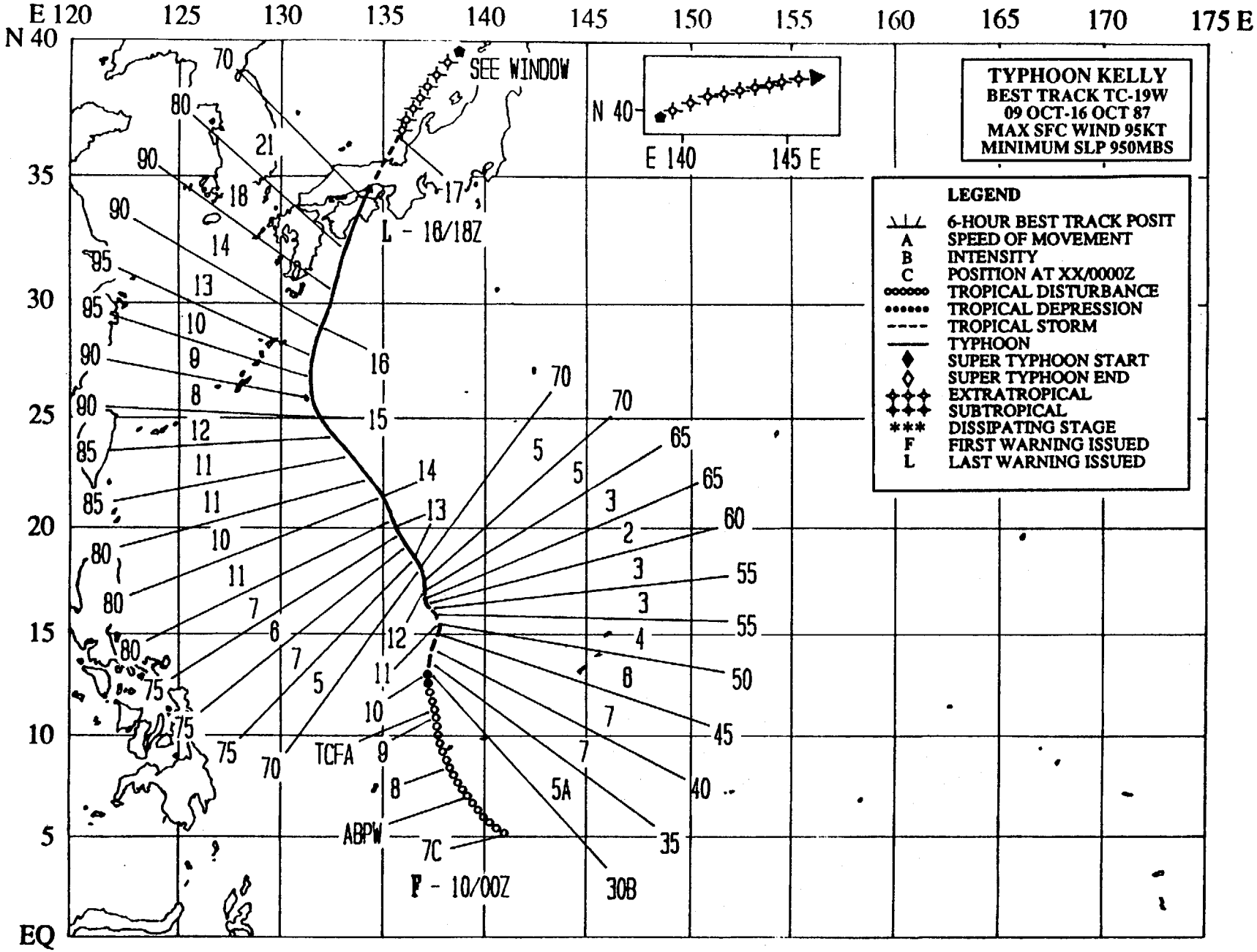
TYPHOON KELLY
BEST TRACK TC-19W
09 OCT-16 OCT 87
MAX SFC WIND 95KT
MINIMUM SLP 950MBS
LEGEND
6-HOUR BEST TRACK POSIT
SPEED OF MOVEMENT
INTENSITY
POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEE WINDOW
L - 16/18Z
F - 10/00Z
TCFA
ABPW
E 120
125
130
135
140
145
150
155
160
165
170
175 E
N 40
35
30
25
20
15
10
5
EQ
E 140
145 E

TYPHOON KELLY (19W)

Typhoon Kelly was the first of two significant tropical cyclones to develop during the month of October. It moved steadily on a northward track, reaching its maximum intensity at the point of recurvature near 28 degrees North Latitude. Kelly made landfall on the Japanese island of Shikoku about 100 nm (185 km) southwest of Osaka with typhoon-force winds, then crossed west central Honshu, the main Japanese island, before moving into the Sea of Japan.

After an outbreak of three tropical cyclones in early September, an aclimatological surface ridge developed in the low latitudes which proved to be unfavorable for tropical cyclones genesis for about six days. A similar occurrence took place during the first week of October with Typhoon Ian (16W), Tropical Storm June (18W) and Typhoon Peke (02C). The strong surface ridge was the primary synoptic feature in an area normally dominated by the monsoon trough. The existence of a low-latitude ridge during the height of the tropical cyclone season appeared to be a readjustment mechanism for the unusual northward displacement of the active monsoon trough to 25 degrees North Latitude associated with both multiple-storm outbreaks.

On 6 October cross-equatorial flow returned to the low latitudes from the southern Philippine Islands to the area south of the island of Pohnpei in the eastern Caroline Islands, allowing the monsoonal trough to re-establish itself along 5 degrees North Latitude. Moonlight visual satellite imagery on 7 October indicated a circulation was developing 190 nm (352 km) south of the island of Yap (Figure 3-19-1). The 071400Z Significant Tropical Weather Advisory (ABPW PGTW) mentioned the area and classified its potential for development into a significant tropical cyclone as fair, based on an initial satellite intensity estimate (Dvorak, 1984) of 25 kt (13 m/sec) surface winds and supporting synoptic data.

Over the next 36-hours, the surface pressures at Yap and Koror (WMO 91408) were closely monitored for indications of possible development. Surface pressures at Yap dropped 1.5 mb per day, reaching a minimum of 1005 mb at 090600Z (see Figure 3-19-2).

Visual satellite imagery on 8 October indicated the low-level circulation center was displaced approximately 200 nm (370 km) south of the main convective band. As a result, satellite fixes at night, based only on infrared imagery, were unable to accurately locate the low-level center through the high cirrus shield.

A Tropical Cyclone Formation Alert was issued on the tropical disturbance at 090330Z, based on increased cirrus outflow and

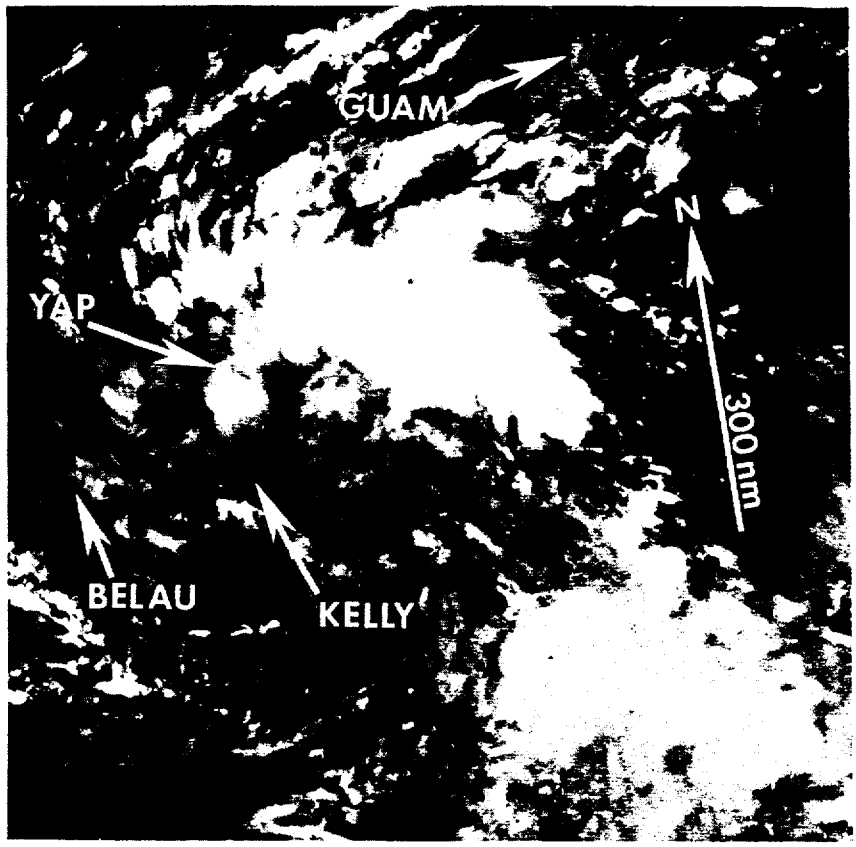

Figure 3-19-1. Moonlight visual imagery showing Typhoon Kelly at an early stage of development (071243Z October DMSP visual imagery).

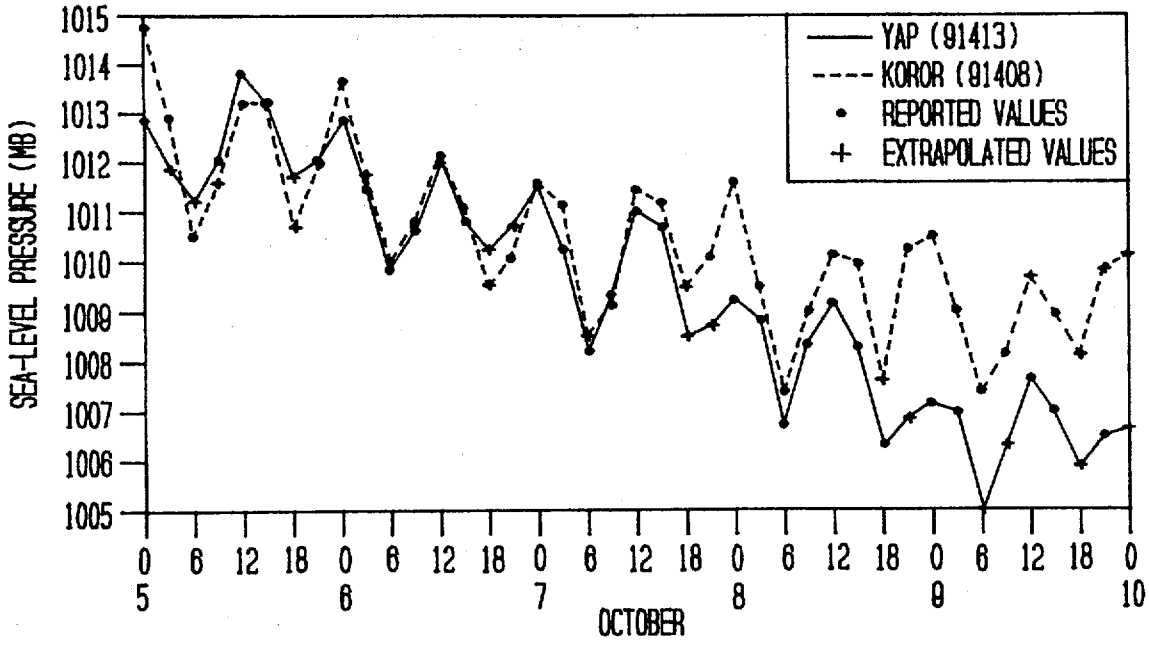

Figure 3-19-2. A plot of the surface pressures for Yap and Koror for the time period 050000Z to 100000Z October (missing values are extrapolated for continuity purposes). Although pressures were dropping at both stations, the lower surface pressures and more rapid falls at Yap indicated the low pressure center was passing close by.

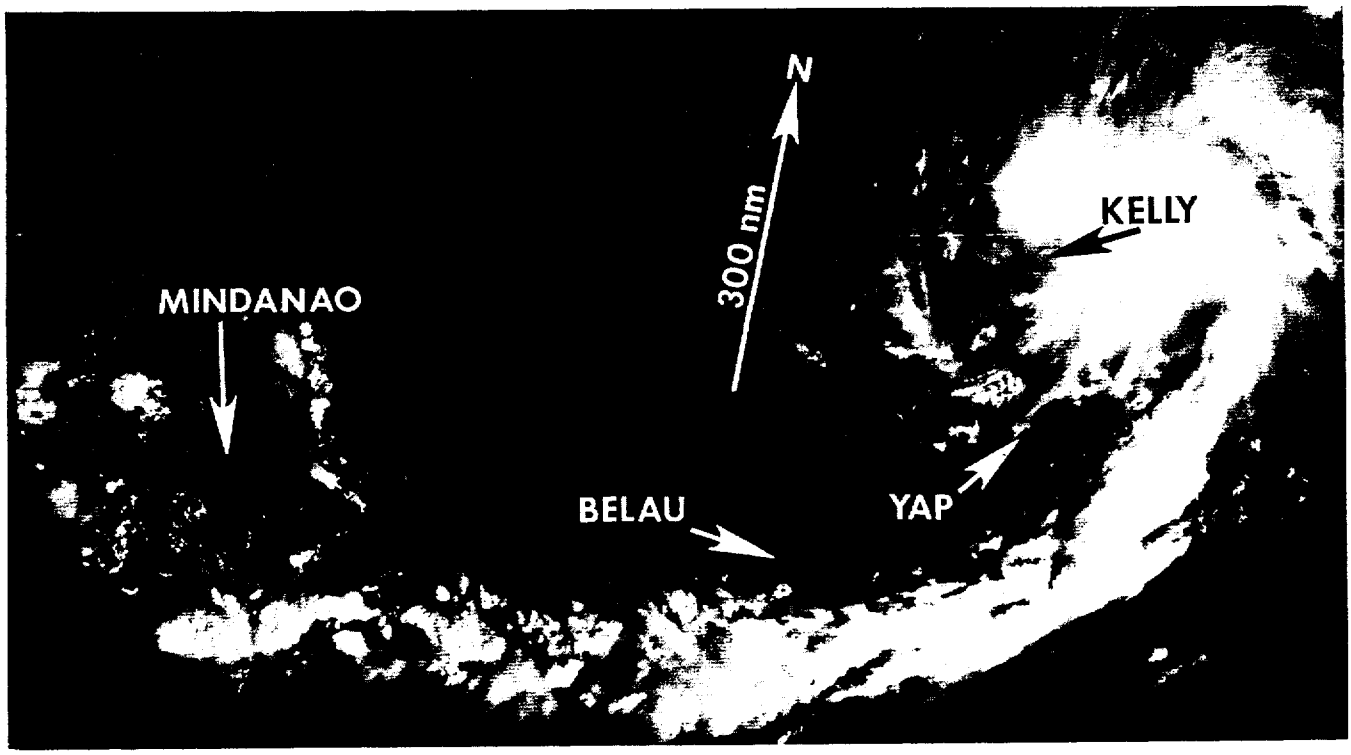

Figure 3-19-3. The low-level circulation center located west of the convective cloud mass is partially obscured by cirrus blow-off. A convective band south of Kelly identifies an area of intense convergence which extended as far west as the island of Mindanao (100043Z October DMSP visual imagery).

persistent convection around the exposed low-level circulation center. Satellite imagery over the next 24-hours showed a steady increase in the amount of convection within the cloud system. The first warning on Tropical Depression 19W was issued at 100000Z, supported by a satellite intensity estimate of 30 kt (15 m/sec). At the time of the first warning, the low-level center was still located about 60 nm (111 km) west of the dense convection (see Figure 3-19-3).

A 35 kt (18 m/sec) ship report 30 nm (56 km) north-northwest of the circulation center at 101200Z supported the earlier upgrade to tropical storm and previous satellite estimates that Kelly had attained tropical storm intensity. The low-level center position remained 95 nm (176 km) southwest of the upper-level circulation center at that time. This separation between the low- and upper-level positions

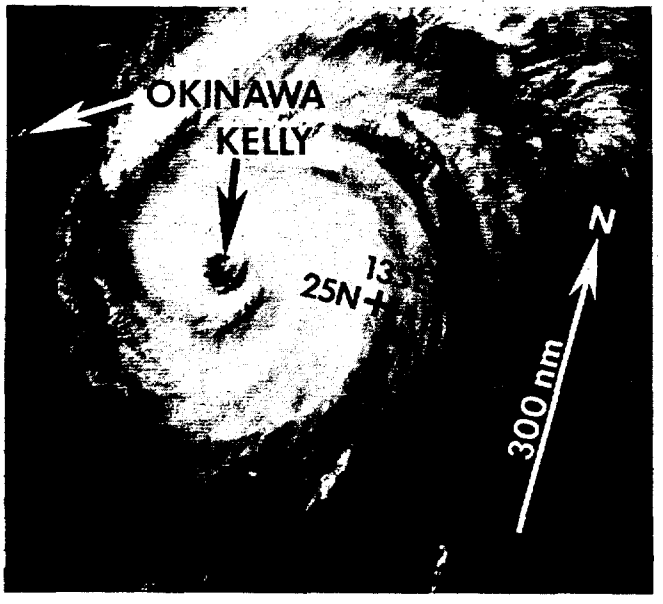

Figure 3-19-4. Typhoon Kelly approximately twelve hours prior to its reaching its maximum intensity of 95 kt (49 m/sec) (150042Z October DMSP visual imagery).

resulted in initial position relocations on the 101200Z and 101800Z warnings.

Once the low- and upper-level centers became aligned on the 11th, Kelly slowly intensified. Minimal typhoon intensity of 65 kt (33 m/sec) was reached at 120000Z. Kelly's intensity peaked at 95 kt (49 m/sec) near the point of recurvature at 151200Z (Figure 3-19-4).

By that time, Typhoon Kelly posed a serious threat to Japan. As it began to slow its forward speed and recurve near the 28th parallel, the forecast question was whether the system would continue to track northward across Japan or recurve south of Japan. Synoptic data at 150000Z indicated the upper-level westerly winds south of Japan were nearly zonal, which would tend to steer Kelly toward the east-northeast, favoring the south of Honshu scenario. This reasoning prevailed and recurvature south of Japan was forecast. By 160000Z however, a mid-level long-wave trough, anchored near the Yellow Sea, deepened as an intense short wave came in phase with the trough axis. Consequently, the steering flow ahead of the trough shifted from westerly to south-southwesterly and Kelly continued its course across Japan instead of recurving sharply northeastward.

Typhoon Kelly weakened only slightly as it began to assume extratropical characteristics on the 16th. Synoptic reports indicated Kelly did not dissipate as rapidly as implied from satellite imagery. Upper-air reports at Shiono, Japan (WMO 47778) revealed that Kelly still packed winds of 95 kt (49 m/sec) at the 850 mb level at 161200Z.

Eventually, Typhoon Kelly made landfall on the southern coast of the island of Shikoku. At least 13,000 homes were flooded and another 30 were badly damaged by mudslides triggered by as much as 20 inches (51 cm) of rain. Wind gusts were reported as high as 120 kt (62 m/sec) as typhoon-force winds battered southern Japan. At least eight people were killed.

After crossing the islands of Shikoku and Honshu, Kelly moved offshore and became extratropical over the Sea of Japan. Later, Misawa Air Base (WMO 47580), located near the northern tip of Honshu, reported maximum surface winds of 32 kt (16 m/sec) and a surface pressure of 985 mb as the extratropical low passed between the islands of Honshu and Hokkaido at 171200Z. The residual circulation of Typhoon Kelly was no longer visible on satellite imagery after 180300Z.